

Memorandum

To: Interested Parties

Date : April 10, 2006

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From: **California Energy Commission** - Gary Flamm

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Buildings and Appliances Office

Subject: **STAFF NOTES ON ECONOMIC ANALYSIS OF PROPOSED
APPLIANCE EFFICIENCY REGULATIONS - 2006 APPLIANCE
RULEMAKING 1**

The purpose of this memo is to demonstrate that amendments proposed to the California Appliance Energy Efficiency Regulations, as set forth in the 15-Day Language dated April 10, 2006 are cost effective as required under Public Resources Code section 25402(c), and to quantify the energy savings that will be realized by these amendments.

Background

Since 1975, Section 25402 (c) of the Public Resources Code has required the California Energy Commission (Energy Commission) to adopt standards for the energy efficiency of appliances. New and upgraded standards must be feasible and attainable, and cannot “result in any added total costs to the consumer over the designed life of the appliances concerned.” This added total cost is determined by comparing the costs and performance of a typical model assuming the proposed standard is in effect, to a typical model without the proposed standard in effect.

On December 15, 2004, the Energy Commission adopted amendments to the California Appliance Efficiency Regulations (California Code of Regulations, Title 20, Sections 1601-1608). The proposed amendments, known as 15 day language, were published on November 30, 2004, and they contained two proposals (Alternative 1 and Alternative 2) for provisions in 1605.3(k) (2), Table K-3 (Energy Efficiency Standards for State-Regulated General Service Incandescent Lamps), 1605.3 (k) (3), Table K-4 (Energy Efficiency Standards for State-Regulated Incandescent Reflector Lamps), and 1605.3 (n) (3), Table N-1 (Energy Efficiency Standards for Metal Halide Luminaires).

The Energy Commission decided to adopt Alternative 2, but directed the Efficiency Committee to continue to work on lighting standards, including a further examination of Alternative 2.

This memo addresses the cost-effectiveness of the proposed amendments that have been developed as a result of this continued work – i.e., the 15-Day Language published on April 10, 2006.

Analysis

Data from a number of different documents is used in this memo to demonstrate that the amendments in the proposed 15-Day Language is cost effective, and to quantify the energy savings. Some documents used are referenced as endnotes.

Analysis for Proposed Amendments for State-Regulated General Service Incandescent Lamps

Assumptions and inputs¹ for Table 1 and Table 2: (1) Incremental improvement cost of proposed efficient lamp = \$0.25 per lamp for 60, 75, and 100 watt lamps, and \$0.20 per lamp for 40 watt lamps. (2) Lamp life = 1,000 hr; (3) Annual hours of operation = 1000. (4) Cost of electricity = \$0.115 per kWh. (5) Simple payback = Total annual California statewide impact cost increase to improve lamp, divided by total annual cost savings. (6) Proposed Wattage = more efficacious lamps which have equivalent lumens to the lower efficacy baseline wattage lamps they replace.

Table 1 Frost / Clear										
	Annual California Statewide Impact				Annual California Statewide Impact					Simple Payback (years)
Baseline Wattage	Number of Lamps	Energy Use (kWh)	Energy Costs (\$)	Proposed Wattage	Energy Use (kWh)	Energy Costs (\$)	Energy Savings (kWh)	Cost Savings (\$)	Increase (\$ to Improve Lamp)	
40	2,807,771	112,310,840	12,915,747	38	106,695,298	12,269,959	5,615,542	645,787	561,554	
60	6,312,060	378,723,600	43,553,214	57	359,787,420	41,375,553	18,936,180	2,177,661	1,578,015	
75	3,196,726	239,754,450	27,571,762	71	226,967,546	26,101,268	12,786,904	1,470,494	799,182	
100	4,071,127	407,112,700	46,817,961	95	386,757,065	44,477,062	20,355,635	2,340,898	1,017,782	
Totals:	16,387,684	1,137,901,590	138,579,345		1,080,207,329	124,223,843	57,694,261	6,634,840	3,956,532	0.60

Table 2 Soft White										
	Annual California Statewide Impact				Annual California Statewide Impact					Simple Payback (years)
Baseline Wattage	Number of Lamps	Energy Use (kWh)	Energy Costs (\$)	Proposed Wattage	Energy Use (kWh)	Energy Costs (\$)	Energy Savings (kWh)	Cost Savings (\$)	Increase (\$ to Improve Lamp)	
40	6,913,961	276,558,440	31,804,221	38	262,730,518	30,214,010	13,827,922	1,590,211	1,382,792	
60	5,402,783	1,524,166,980	175,279,203	57	1,447,958,631	166,515,243	76,208,349	8,763,960	6,350,696	
75	15,131,053	1,134,828,975	130,505,332	71	1,074,304,763	123,545,048	60,524,212	6,960,284	3,782,763	
100	9,338,296	933,829,600	107,390,404	95	887,138,120	102,020,884	46,691,480	5,369,520	2,334,574	
Totals:	56,786,093	3,869,383,995	471,232,930		3,672,132,032	422,295,184	197,251,963	22,683,976	3,850,825	0.61

Analysis for Proposed Amendments for State-Regulated Incandescent Reflector Lamps

The “Analysis in Support of the Proposed ACEEE/NEMA Compromise On Standards for Incandescent Reflector Lamps,” November 30, 2005, written by the American Council for an Energy-Efficient Economy is used to demonstrate that the proposed amendments for State-regulated incandescent reflector lamps are cost effective, and to quantify the energy savings. Table 14A of the ACEEE/NEMA Compromise (shown as Table 3 below) is used for the present value of energy savings, and Table 14B (shown as Table 4 on the following page) is used for simple payback.

Assumptions and inputs for Table 3 and Table 4: (1) Average daily operating hours, residential = 2.3, commercial = 10, weighted average = 4.225 (operating hours per year and peak coincidence for a lamp varies as the relative residential and commercial market); (2) Cost of electricity = \$0.115 per kWh.; (3) Reduced total cost over the design life of the appliance (\$) is the energy savings that occurs over the life of the lamp.

Table 3 - Present Value of Energy Savings of Incandescent Reflector Lamps							
Base Lamp Type	Design Life (Years)*	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings (\$) @ \$0.115/kWh	Annual Sales (million units)	First-year Statewide Energy Savings (million kWh)	Incremental Cost of Improvement per unit (\$)	Reduced Total Cost over the Design Life of the Appliance (\$)
75 watt BR40 and 85 watt BR40	0.76	39	4.48	3.15	75	\$ 0.97	\$ 2.46
100 watt BR40	0.96	171	19.66	1.12	116	\$ 2.26	\$ 16.51
120 watt BR40	0.96	116	13.34	1.68	118	\$ 2.03	\$ 10.68
75 watt BPAR	1.23	16	1.84	1.07	20	\$ 1.50	\$ 0.74
100 watt BPAR	1.31	128	14.72	0.46	44	\$ 2.59	\$ 16.71
150 watt BPAR	1.00	161	18.51	2.01	205	\$ 2.31	\$ 16.19
R20	0.91	12	1.39	4.89	51	\$ 0.58	\$ 0.65
Total or Weighted Average	0.93	61	7.01	14.39	626	\$ 1.28	
* = varies based on average annual operating hours and life of lamps used to comply with proposed Standards.							

Table 4- Simple Payback for Incandescent Reflector Lamps					
Base Lamp Type	Added First Cost Per Unit	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings (\$) @ \$0.115/kWh	Design Life (years)	Simple Payback Period (years)
75 watt BR40 and 85 watt BR40	0.97	39	4.48	0.76	0.22
100 watt BR40	2.26	171	19.66	0.96	0.11
120 watt BR40	2.03	116	13.34	0.96	0.15
75 watt BPAR	1.50	16	1.84	1.23	0.82
100 watt BPAR	2.59	128	14.72	1.31	0.18
150 watt BPAR	2.31	161	18.51	1.00	0.13
R20	0.58	12	1.39	0.91	0.43
Total or Weighted Average	1.28	61	7.01	0.93	0.18

Analysis for Proposed Amendments for Metal Halide Luminaires

Assumptions and inputs ² for Table 5 and Table 6:

(1) Hours of operation = 12 hours/day x 365 day/year = 4380 annual hours.

(2) Cost of electricity = \$0.115 per kWh.

(3) Representative lamp wattages distributed as 75% = 400 watt, 10% = 250 watt, 10% = 175 watt, and 5% = 150 watt.

(4) Proposed probe-start to pulse-start lamps

- Incremental improvement annual cost of lamps = \$30 divided by 4.5 year life.*
- Number of lamps affected statewide = 15% of 363,000 lamps (includes only lamps not rated as vertical).*

(5) Proposed ballast efficiency of 88%

- Incremental improvement annual cost of proposed typical ballast to 88% efficient ballast = \$30 divided by 13.5 years.*
- Number of ballasts affected statewide = 363,000*

Table 5 Probe-Start to Pulse-Start Metal Halide Lamps										
Baseline Lighting System					Proposed Lighting System					
		Annual California Statewide Impact					Annual California Statewide Impact			
Probe-Start Lamp Wattage	System Wattage	Number of Lamps Affected	Energy Use (kWh)	Energy Costs (\$)	Pulse-Start Lamp Wattage	System Wattage	Annual Energy Use (kWh)	Annual Energy Costs (\$)	Annual Energy Savings (kWh)	Annual Cost Savings (\$)
150	185	2,723	2,206,042	253,695	100	129	1,538,267	176,901	667,775	76,794
175	210	5,445	5,008,311	575,956	150	185	4,412,084	507,390	596,228	68,566
250	288	5,445	6,856,616	788,511	200	240	5,723,784	658,235	1,132,832	130,276
400	460	40,838	82,279,395	9,462,130	350	370	66,181,253	7,610,844	16,098,143	1,851,286
Totals:		54,450	96,350,364	11,734,029			77,855,387	8,953,369	18,494,977	2,126,922

Table 6 88 % Ballast Efficiency										
Baseline Lighting System					Proposed Lighting System					
		Annual California Statewide Impact					Annual California Statewide Impact			
Pulse-Start Lamp Wattage	System Wattage	Number of Ballasts Affected	Energy Use (kWh)	Energy Costs (\$)	Pulse-Start Lamp Wattage	System Wattage	Annual Energy Use (kWh)	Annual Energy Costs (\$)	Annual Energy Savings (kWh)	Annual Cost Savings (\$)
100	129	18,150	10,255,113	1,179,338	100	128	10,175,616	1,170,196	79,497	9,142
150	185	36,300	29,413,890	3,382,597	150	183	29,095,902	3,346,029	317,988	36,569
200	240	36,300	38,158,560	4,388,234	200	238	37,840,572	4,351,666	317,988	36,569
350	370	272,250	441,208,350	50,738,960	350	366	436,438,530	50,190,431	4,769,820	548,529
Totals:		363,000	519,035,913	63,210,789			513,550,620	59,058,321	5,485,293	630,809

Table 7 Simple Payback									
Probe-Start to Pulse Start Metal Halide Lamps		88 % Ballast Efficiency		Combined Pulse-Start Lamps plus 88% Ballast Efficiency		Incremental Annual Costs			
Annual Energy Savings (kWh)	Annual Cost Savings (\$)	Annual Energy Savings (kWh)	Annual Cost Savings (\$)	Annual Energy Savings (kWh)	Annual Cost Savings (\$)	Lamp Cost (\$)	Ballast Cost (\$)	Lamp + Ballast Cost (\$)	Simple Payback (years)
From Table 5		From Table 6							
18,494,977	2,126,922	5,485,293	630,809	23,980,270	2,757,731	363,000	806,667	1,169,667	0.4

Assumptions used to develop simple payback in Table 7 were taken from Table 5 and Table 6.

(1) Annual Energy Savings from Table 5 + Annual Energy Savings from Table 6 = Annual Energy Savings (kWh) for Combined Pulse-Start Lamps plus 88% Ballast Efficiency

(2) Annual Cost Savings from Table 5 + Annual Cost Savings from Table 6 = Annual Cost Savings (\$) for Combined Pulse-Start Lamps plus 88% Ballast Efficiency

(3) Incremental Annual Lamp Cost = (\$30 per lamp divided by 4.5 years) times (number of lamps affected)

(4) Incremental Ballast Costs = (\$30 per ballast divided by 13.5 years) times (number of ballasts affected)

(5) Simple Payback (years) = (Annual Lamp plus Ballast Costs) divided by (Annual Cost Savings)

¹ Codes and Standards Enhancement Initiative For PY2004: Title 20 Standards Development; Analysis of Standards Options for General Service Incandescent Lamps; Prepared for: Gary B. Fernstrom, PG&E; September 13, 2004.

² Codes and Standards Enhancement Initiative For PY2004: Title 20 Standards Development, Analysis of Standards Options for Metal Halide Lamps and Fixtures, Prepared for Gary B. Fernstrom, PG&E, August 10, 2004.